

What is Claimed:

1. A valve actuation system for use in an internal combustion engine comprising at least one combustion cylinder having a piston and an engine valve, said valve actuation system comprising:

a hydraulic pump configured to produce a hydraulic output based on a valve-piston clearance profile of at least one cylinder of said combustion engine;

a high-pressure reservoir coupled with said hydraulic pump; and

an electro-hydraulic valve actuator coupled with said high-pressure reservoir and configured to actuate at least one engine valve of said combustion engine according to an output of said hydraulic pump.

2. The valve actuation system recited in claim 1, further comprising at least one feedback loop from said electro-hydraulic valve actuator to said high-pressure reservoir, such that when the pressure in said high-pressure reservoir is lower than the pressure in said electro-hydraulic valve actuator, hydraulic fluid travels from said electro-hydraulic valve actuator back to said high-pressure reservoir.

3. The valve actuation system recited in claim 1, wherein said hydraulic pump includes a cam and a plunger, said cam having a shape selected to produce said hydraulic output based on said valve-piston clearance profile of said at least one engine cylinder, such that said plunger moves toward said cam when valve-piston clearance of said piston and said engine valve approaches zero.

4. The valve actuation system recited in claim 1, wherein said electro-hydraulic valve actuator includes a control chamber coupled with said high-pressure reservoir and at least one plunger fluidly connected with said control chamber and mechanically connected to said at least one engine valve, and said valve actuation

system further comprising at least one feedback loop from said control chamber to said high-pressure reservoir.

5. The valve actuation system recited in claim 4, wherein said at least one feedback loop comprises a first feedback loop having a first check valve disposed therein, said first check valve configured to allow hydraulic fluid to flow from said control chamber to said high-pressure reservoir when the pressure in said control chamber exceeds the pressure in said high-pressure reservoir.

6. The valve actuation system recited in claim 5, wherein said at least one feedback loop further comprises a second feedback loop having a control valve disposed therein.

7. The valve actuation system recited in claim 5, wherein said at least one feedback loop further comprises a second feedback loop having a second control valve and a second check valve disposed therein, wherein when said second control valve is open, hydraulic fluid is permitted to flow to low-pressure region, and said second check valve allows hydraulic fluid to flow from low-pressure region to said high-pressure reservoir when the pressure in said high-pressure reservoir is below the pressure in said low-pressure region.

8. The valve actuation system recited in claim 5, further comprising an accumulator coupled with said high-pressure reservoir.

9. The valve actuation system recited in claim 8, wherein said accumulator stores excessive hydraulic fluid and functions such that said check valve is permitted to open in response to high-pressure changes in fluid pressure.

10. A valve actuation method for use in an internal combustion engine comprising at least one combustion cylinder having a piston and an engine valve, said engine comprising an electro-hydraulic valve actuation system for opening and

closing said engine valve, said valve actuation system comprising a hydraulic pump including a plunger mechanically coupled with a cam, said cam moving said plunger to create hydraulic pressure and being mechanically coupled to an engine crankshaft, said electro-hydraulic valve actuation system also including a second plunger fluidly connected with said hydraulic pump and mechanically connected with said engine valve for opening and closing said engine valve, said method comprising steps of:

- determining a piston-valve clearance profile of said piston and said engine valve for said at least one combustion cylinder; and

- selecting a shape of said cam of said hydraulic pump based on said piston-valve clearance profile, such that said plunger moves toward said cam when valve-piston clearance of said piston and said engine valve approaches zero.

11. The method recited in claim 10, wherein said valve actuation system further comprises a control chamber coupled with a high-pressure reservoir via a control valve, said method further comprising a step of:

- coupling an accumulator with said high-pressure reservoir; and

- providing a feedback loop from said control chamber to said high-pressure reservoir via a check valve, such that when the pressure in said control chamber exceeds the pressure in said high-pressure reservoir, hydraulic fluid flows to said high-pressure reservoir from said control chamber to prevent piston-valve collision.

12. The method recited in claim 10, further comprising a step of configuring said accumulator such that said check valve is permitted to open in response to high-pressure changes in fluid pressure

13. A valve actuation system for use in an internal combustion engine comprising at least one combustion cylinder having a piston and an engine valve, said valve actuation system comprising:

a pump means for producing a hydraulic output based on a valve-piston clearance profile of at least one cylinder of said combustion engine; and

a valve actuation means for actuating at least one engine valve of said combustion engine according to an output of said pump means.

14. The valve actuation system recited in claim 13, further comprising feedback means for redirecting hydraulic fluid from said valve actuation means when the engine piston moves close to the engine valve.

15. The valve actuation system recited in claim 14, further comprising accumulator means for storing excessive hydraulic fluid from the output from said pump means.